筑波大学

平成29年度　個別学力試験問題

外　国　語　(英　語)

(120分)

人文・文化学群　(人文学類，比較文化学類，日本語・日本文化学類)
社会・国際学群　(社会学類，国際総合学類)
人　間　学　群　(教育学類，心理学類，障害科学類)
生命環境学群　(生物学類，生物資源学類，地球学類)
理　工　学　群　(数学類，物理学類，化学類，応用理工学類，
工学システム学類，社会工学類)
情　報　学　群　(情報科学類，情報メディア創成学類，
知識情報・図書館学類)
医　　学　　群　(医学類，看護学類，医療科学類)

注　　意

1　問題冊子は1ページから10ページまでである。
2　解答は解答用紙の定められた欄に記入すること。

I　次の英文を読んで，下の問いに答えなさい。
(星印(＊)のついた語には本文の後に注があります。)

Music is not tangible. You can't eat it, drink it or mate with it. It doesn't protect against the rain, wind or cold. It doesn't defeat predators or mend broken bones. And yet humans have always loved it. In the modern age we spend great sums of money to attend concerts, download music files, play instruments and listen to our favorite artists whether we're in a subway or salon. But even in the Old Stone Age, people invested significant time and effort to create music, as the discovery of flutes carved from animal bones would suggest. So why does this thingless "thing"— at its core, a (ア) sequence of sounds — hold such potentially enormous value? The quick and easy explanation is that music brings a unique pleasure to humans. Of course, that still leaves the question of why. But for that, neuroscience* is starting to provide some answers.

More than a decade ago, our research team used brain imaging to show that music that people described as highly emotional engaged the reward system deep in their brains — activating subcortical* nuclei known to be important in reward, motivation and emotion. And we found that listening to what might be called "peak emotional moments" in music causes the release of dopamine, an essential signaling molecule in the brain. When pleasurable music is heard, dopamine is released in an ancient part of the brain found in other animals as well.

But what may be most interesting here is *when* dopamine is released: not only when the music rises to a peak emotional moment, but also several seconds before, during what we might call the (イ) phase. The idea that reward is partly related to anticipation (or the prediction of a desired outcome) has a long history in neuroscience. Making good predictions about the outcome of one's actions would seem to be essential in the context of survival, after all. And dopamine neurons, both in humans and other animals, play a role in recording which of our predictions turn out to be correct.

To dig deeper into how music engages the brain's reward system, we designed a study to simulate online music purchasing. Our goal was to determine what goes on in the brain when someone hears a new piece of music and decides he likes it enough to buy it. We used music-recommendation programs to modify the selections to suit our listeners' preferences. And we found that neural activity within the reward-related structure was directly proportional to the amount of money people were willing to spend.

But more interesting still was the cross talk* between this structure and the auditory cortex*, which also increased for songs that were ultimately purchased compared with those that were not. Why the auditory cortex? Some 50 years ago, Wilder Penfield, the famous neurosurgeon and the founder of our institute in Montreal, reported that when neurosurgical patients received electrical stimulation to the auditory cortex while they were awake, they would sometimes report hearing music. Dr. Penfield's observations, along with those of many others, suggest that musical information is likely to be represented in these brain regions.

The auditory cortex is also active when we imagine a tune: think of the first four notes of Beethoven's Fifth Symphony — your cortex is buzzing! <u>This ability</u> (1) allows us not only to experience music even when it's physically absent, but also to invent new compositions and to reimagine how a piece might sound with a different tempo or instrumentation. We also know that these areas of the brain encode the abstract relationships between sounds — for instance, the particular sound pattern that makes a major chord major, regardless of the key or instrument. Other studies show distinctive neural responses from similar regions when there is an unexpected break in a repetitive pattern of sounds. This is akin to what happens if you hear someone play a wrong note — easily noticeable even in an unfamiliar piece of music.

These cortical circuits allow us to make predictions about coming events on the basis of past events. They are thought to accumulate musical information over our lifetime, creating models of the statistical regularities that are present in the music of our culture and enable (2) us to understand the music we hear in relation to our stored mental representations of the music we've heard. So each act of listening to music may be thought of as both summarizing the past and predicting the future. When we listen to music, these brain networks actively create expectations based on our stored knowledge. Composers and performers instinctively understand this (3): they handle these prediction mechanisms to give us what we want — or to surprise us, perhaps even with something better.

In the cross talk between our cortical systems, which analyze patterns and yield expectations, and our ancient reward and motivational systems, may lie the answer to the question: does a particular piece of music move us? When that answer is yes, there is little — in those moments of listening, at least — that we value more.

(注)

neuroscience：神経科学。neuro-, neural は「神経の」

subcortical：皮質下の

cross talk：クロストーク。生物学用語で，あるシグナル伝達経路が情報を伝える際，他の伝達経路と影響し合うこと

auditory cortex：聴覚皮質，聴覚野。cortical は「皮質の」

1. 空所（　ア　）に入る最も適切な語を次の中から１つ選び，記号で答えなさい。

(A) joyful　(B) long　(C) mere　(D) particular

2. 空所（　イ　）に入れる語として不適切なものを次の中から１つ選び，記号で答えなさい。

(A) anticipation　(B) emotion　(C) expectation　(D) prediction

3. 下線部(1)の This ability とはどのような能力か，30字以内の日本語で説明しなさい。

4. 下線部(2)の enable を最も適切な形に書き換えなさい。

5. 下線部(3)の this とはどのようなことか，50字以内の日本語で説明しなさい。

6. 次のそれぞれの記述について，本文の内容に合っているものには T を，そうでないものには F を記入しなさい。

(A) No one has ever tried to answer why music gives us a rare pleasure which is totally different from any other pleasure.

(B) Research shows that our experiences of listening to music are closely related to the reward system in our brains.

(C) Dopamine neurons are important in that they help us memorize the results of our predictions.

(D) The author and his research team bought many expensive songs online and asked people to participate in their experiments with music.

(E) When a new piece of music stimulates the cross talk between the reward-related structure and the auditory cortex in our brains, we are often confused and decide not to buy it.

(F) We judge a particular piece of music by examining the prediction mechanisms in its composer's and performer's brains.

Ⅱ　次の英文を読んで，下の問いに答えなさい。
　（星印（＊）のついた語には本文の後に注があります。）

Plato, Newton, Da Vinci, Goethe, Einstein: All these great minds and many more struggled with the profound complexity of color. They sought to understand it, creating systems to explain its mysterious workings. Some were more successful than others, and from the viewpoint of our current scientific knowledge, many of their attempts now seem funny, strange, or fanciful*.

Color is everywhere, but most of us never think to ask about its origins. The average person has no idea why the sky is blue, the grass green, the rose red. We take such things for granted. But the sky is not blue, the grass is not green, the rose is not red. (1) It has taken us centuries to figure this out.

It stands to reason that for thousands of years, many casual observers must have seen what Newton did: that light passing through a prism creates a rainbow on the surface （　ア　） it lands; but Newton saw something no one else had seen. He deduced* that the white light that appears to surround us actually contains all the different colors we find in a rainbow. White was not separate from these colors — or a color by itself — but was the result of all colors being reflected at once. This revolutionary theory did not take hold easily. Some of those greatest minds we mentioned simply wouldn't accept this theory. The idea that white light contained all color upset Goethe so that he refused — and demanded others refuse — even to attempt Newton's experiment.

Although Newton's discovery was more than enough to upset his contemporaries, (2) he didn't stop there; Newton also found out that colors refracted* through a prism could not be changed into other colors. Here's （　イ　） he did it. He took a prism and placed it between a beam of light (coming from the hole in his window shutters) and a board with a small hole in it. The hole in the board was small enough that it only allowed one of the refracted colors to pass through it. He then placed all kinds of materials (including a second prism) in front of the beam passing through the small hole to try to alter the refracted color passing through the small hole. Prior to the experiment, he had believed that if, for example, a blue piece of glass was placed in front of a red beam of light, the red would be transformed into another color. But he found that this was not the case. No matter (ウ) color or type of material he placed in front of an individual beam of light, he couldn't get the refracted color to change. From this experiment, he deduced that there was a certain number of what he called "spectral" colors — colors that cannot be broken down, colors that are fundamental.

Once Newton confirmed that his spectral colors were unchangeable, he decided to name them — and here's (エ) his method takes a turn from the scientific to the fanciful. Taken with the idea that the rainbow should reflect the musical scale, Newton decided to name his colors in accordance with aesthetics*. There are seven main tones in the musical scale, so Newton came up with seven corresponding colors. Hence the origin of ROYGBIV, the acronym by (オ) we know Newton's seven spectral colors — red, orange, yellow, green, blue, indigo, and violet.

Although the relationship to music was later set aside(3) by scientists who questioned the basis for comparison, ROYGBIV is still used today as a teaching tool, even though indigo is not a color most people can even identify.

The truth is, there's no perfect way to name the colors of the rainbow. Take a look at a real rainbow, and you'll see that its colors merge seamlessly* from one to the other. Any judgment on where one color ends and the other begins is arbitrary. Even Newton was not sure on this point. At the beginning of his experimentation, his spectrum included eleven colors. Once he'd reduced the number down to seven, he still thought of orange and indigo as less important.

There's another issue with naming the colors of the rainbow: The language of color is fluid, changing over time and across geographies in response to cultural forces that are sometimes too complex to pin down. For example, the color Newton called indigo is the one most people would identify as plain old blue or a true blue that falls midway between green and violet. Newton's blue is what we now call cyan, a more turquoise blue that falls between blue and green.

(注)

fanciful: based on imagination and not facts or reason

deduce: to form an opinion about something based on the information or evidence that is available

refract: to make light change direction when it goes through water, glass, etc.

aesthetics: a set of principles about beauty or art

merge seamlessly: if two things merge seamlessly, you cannot clearly see them as separate things

1. 下線部(1)の内容を，this が何を指しているかを明らかにしながら，50字以内の日本語で説明しなさい。

2. 空所（ ア ）～（ オ ）に入る最も適切な語を次の中から1つ選び，記号で答えなさい。ただし，同じ語が2回以上使われることもあり得ます。

(A) who (B) what (C) where (D) which (E) how

3. ニュートンの説に対するゲーテの反応を表す語句として最も適切なものを次の中から1つ選び，記号で答えなさい。

(A) fairly favorable

(B) strongly opposed

(C) utterly neutral

(D) deeply concerned

4. 下線部(2)の意味と内容的に<u>合っていない</u>ものを次の中から1つ選び，記号で答えなさい。

(A) Newton carried out an additional experiment.

(B) Newton made another proposal about the nature of color.

(C) Newton criticized his contemporaries.

(D) Newton was not satisfied with his own theory.

5. 下線部(3)の言い換えとして最も適切な語を次の中から1つ選び，記号で答えなさい。

(A) considered (B) compared (C) identified (D) ignored

6. 虹の色を命名する際にどのような問題があるか，60字以内の日本語で要点を説明しなさい。

7. 次のそれぞれの記述について，本文の内容に合っているものにはTを，そうでないものにはFを記入しなさい。

(A) Newton's theory about the nature of white light was not accepted by many people at his time.

(B) Before performing an experiment, Newton had expected that there are spectral colors.

(C) There are no reasonable grounds for naming spectral colors in accordance with aesthetics.

(D) ROYGBIV stands for the seven main tones in the musical scale.

Ⅲ　都市部で起こる車両の渋滞問題に関する次の英文を読んで，下の問いに答えなさい。

City centers around the world have taken different approaches to dealing with the traffic jam. For example, London has a congestion charge in an attempt to reduce the volume of traffic. Los Angeles and Sydney have "carpool" lanes and Athens restricts the days on which cars can enter the city. This debate suggests going further with <u>a complete ban on cars in city centers, excluding emergency vehicles, buses, taxis, deliveries and cars for people with disabilities.</u>

Student A: In many more economically developed countries, road accidents are the single biggest cause of deaths in children and teenagers. Completely banning cars from city centers would reduce accident rates and save lives as many schools and houses are on busy roads. Bus drivers do not drink and drive, speed, or talk on their phones while driving; (1)(イ private　ロ who　ハ it　ニ accidents　ホ car drivers　ヘ is　ト cause). With the trend for more cycling, we have also seen increased rates of cyclist accidents that could be prevented.

Student B: Road safety should be a priority and speed limits and other driving regulations should be pursued with strict application of rules to keep accidents to a minimum. Road safety education is also essential in schools. With these measures, it is not necessary to ban cars completely from city centers where traffic and low speed limits keep accident rates down.

Student C: I support this proposition. (2)(イ see　ロ public transport　ハ banning　ニ an improvement　ホ would　ヘ cars　ト in) as more money would be in the system. This in turn would remove the reason that many people wish to drive (that public transport is not good enough) and so would create a virtuous cycle.

1. Student A と Student B は，下線部で述べられている論題に対してそれぞれ賛成の立場なのか反対の立場なのか，解答用紙の賛成か反対のどちらか一方を○で囲みなさい。

Student A：　　賛成　／　反対

Student B：　　賛成　／　反対

2. 上の英文の文脈に適合するように，(1)および(2)の（　　）内の語句を並べ替えるとき，3番目と5番目にくるものをそれぞれ選び，記号で答えなさい。ただし，（　　）内では，文頭にくる語も小文字で示してあります。

(1)　3番目 ______　　5番目 ______

(2)　3番目 ______　　5番目 ______

3. あなたが Student D であるとして，下線部の論題に賛成か反対かを，自分自身の根拠を示しながら，90語程度の英語で述べなさい。ただし，句読点は数える必要はありません。